



UNIVERSITI PUTRA MALAYSIA

**AN ERGONOMIC INVESTIGATION PERTAINING TO WORK
RELATED MUSCULOSKELETAL DISORDER PROBLEMS
OF INDUSTRIAL OPERATORS IN PRESSWORKING
OPERATION**

MEENALOSHINI SATGUNAM

FK 2002 77

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MUSCULOSKELETAL DISORDER PROBLEMS OF INDUSTRIAL
OPERATORS IN PRESSWORKING OPERATION**

**By
MEENALOSHINI SATGUNAM**

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia,
In Fulfilment of the Requirement for the Degree of Master of Science**

November 2002



Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment
of the requirements for the degree of Masters of Science

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November 2002

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Musculoskeletal disorders (MSDs) occur when there is a mismatch between physical requirements of the job and the physical capacity of the human body. Many manufacturing sector industries, especially workers from heavy industries are facing this kind of problem. MSDs have caused lost workdays, injuries, increased the total costs of workers compensation claims, and decreased employee morale, quality and productivity. Keeping these facts in view, present study was planned and investigations were undertaken, in a manufacturing industry, PHN Industry, Shah Alam, Selangor where a cross-sectional study was carried out on a group of male workers in an automotive factory. The objective of the study was to determine the

prevalence of musculoskeletal disorder and its relationship with various work -related and demographic factors.

There were two sets of studies: Qualitative study (Study-1) and Quantitative study (Study -2). Study -1 spanned over investigations related to lower back pain (LBP), neck pain, shoulder pain and wrist pain among workers associated with stamping and assembly operations in the automotive industry. A total of 72 respondents participated in the study. These respondents were selected on the basis of specific characteristics required in the sample, in terms of organismic variables.

All the respondents were, in person, interviewed , on the basis of information required in the translated Nordic's inventory system which served as a basic instrument for the qualitative investigations. Statistical analysis of the data(Study -1) showed that the prevalence of MSDs among the workers was very high with varied levels of complaints of lower back pain (93%), neck pain (65.2%), shoulder pain (25%), and wrist pain (65.3%). Thus the study provided good evidence to demonstrate the existence of MSDs among the industrial workers of the PHN Industry. The data were also analysed in terms of the relationship between MSDs and such variables as age, body mass index, and work duration. In quantitative study (study-2), the Electromyogram (EMG) data involved activity of the erector spinae muscle was measured in each respondent using muscle tester ME3000P System. It was found that there was a significant increase in the mean AEMG (Average Electromyography) readings of both the left and right erector spinae muscles after work when compared with that before the start of the work. On the other hand, there was no significant

decrease in the mean MF (Median Frequency) readings of the both left and right erector spinae muscles for both before and after work.

The mean AEMG difference (before and after) for both the left and right erector spinae muscles was high for workers who complained of lower back pain when compared to those without complaints.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia bagi memenuhi keperluan untuk ijazah Master Sains

KAJIAN ERGONOMIK BERDASARKAN KEPADA KERJA YANG BERKAITAN DENGAN MASALAH GANGGUAN MUSKULOSKELETAL DI KALANGAN OPERATOR PERINDUSTRIAN DALAM KERJA –KERJA PEMBUATAN.

Oleh

MEENALOSHINI SATGUNAM

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Gangguan muskuloskeletal berlaku bila terdapat ketidak seimbangan diantara keperluan kerja fizikal dan keupayaan tubuh badan. Kebanyakan pekerja sektor – sektor pembuatan, terutamanya pekerja dari sektor kerja berat menghadapi masalah ini. Gangguan muskuloskeletal telah menyebabkan gangguan masa kerja kerana terpaksa mengambil cuti rehat, meningkatkan bayaran pampasan pekerja yang terpaksa dibayar oleh majikan, merendahkan semangat pekerja dan juga mutu kerja.

Satu kajian keratan rentas telah dijalankan ke atas pekerja lelaki yang bekerja di kilang automotif di Shah Alam, Selangor dari 24hb Oktober hingga 7hb November 2001. Objektif kajian ini adalah untuk mengkaji gangguan muskuloskeletal dan hubungannya dengan pelbagai kriteria kerja dan faktor demografik. Sejumlah 72 pekerja dipilih untuk kajian ini.

Pemilihan responden berdasarkan kaedah persampelan dilaksanakan dengan menggunakan senarai nama yang diperolehi daripada pihak kilang. Kesemua responden telah ditemuduga dengan menggunakan borang soal-selidik Nordic yang telah diterjemah untuk mendapatkan maklumat latar belakang dan gejala sakit otot dan rangka. Statistik menunjukkan bahawa sakit belakang bahagian bawah dikalangan pekerja kilang automotif adalah tinggi iaitu 93%, sakit leher (65.2%), sakit bahu (25%), dan sakit gelang tangan (65.3%). Kajian ini telah membuktikan kehadiran sakit muskuloskeletal dikalangan pekerja industri automotif di Shah Alam. Data yang diperolehi juga telah dikaitkan dengan umur, index jisim badan, dan tempoh bekerja. Semasa ukuran kuantitatif (kajian-2) dijalankan, pengukuran aktiviti otot erektor spinae telah dilakukan keatas setiap responden dengan menggunakan Muscle Tester ME3000 System. Terdapat peningkatan yang signifikan bacaan purata AEMG otot erektor spinae selepas kerja. Manakala tidak terdapat penurunan yang signifikan bacaan purata MF otot selepas kerja. Purata AEMG kiri dan kanan bagi pekerja yang mempunyai gejala sakit belakang bawah adalah tinggi berbanding pekerja yang tidak mempunyai gejala sakit belakang bawah. Ujian statistik menunjukkan bahawa terdapat perbezaan yang signifikan bacaan min AEMG bag sebelah kanan tetapi bagi sebelah kiri ujian statistik menunjukkan tidak terdapat perbezaan yang signifikan antara pekerja yang mempunyai gejala dan tidak

mempunyai gejala sakit belakang bahagian bawah. Ujian statistik menunjukkan bahawa tidak terdapat perbezaan yang signifikan bacaan purata MF bagi kedua – dua bahagian iaitu sebelah kiri dan kanan .

ACKNOWLEDGEMENTS

The author feels great pleasure at the completion of this thesis and would like to thank and extend her sincere gratitude to all those who helped in the completion of this piece of research. Firstly, the author would like to thank Prof. S A H Rizvi, Dr.Yusof and Dr.Megat for their outstanding guidance, indispensable support, constructive criticism and unbound affection that the author enjoyed during the whole tenure of the thesis.

The author is thankful to En.Azman bin Abdul Aziz (Head of Safety and Health Section) and En. Zainal Abidin (Head of Human Resource) at PHN Industry to grant permission in conducting the research at their company premises.

Finally, this acknowledgement would be incomplete if the author fails to express her deepest thanks to her parents (Mr. Satgunam and Mrs. Indra) and brother (Mr.Sivanandarajah) whose moral support inspired the author to complete her work.

I certify that the Examination Committee met on 8th November 2002 to conduct the final examination of Meenaloshini Satgunam on her Master of Science thesis entitled "An Ergonomic Investigation Pertaining to Work Related Musculoskeletal Disorder Problems of Industrial Operators in Pressworking Operations" in accordance with Universiti Pertanian Malaysia (Higher Degree Act 1980) and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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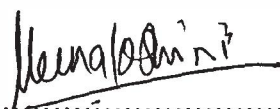


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I hereby declare that the thesis is based on my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.



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TABLE OF CONTENTS

	Page
ABSTRACT	ii
ABSTRAK	v
ACKNOWLEDGEMENTS	viii
APPROVAL	ix
DECLARATION	x
LIST OF TABLES	xii
LIST OF FIGURES	xiv
LIST OF APPENDICES	xv
NOMENCLATURE	xvi
 CHAPTER	
1 INTRODUCTION	
1.1 Musculoskeletal Disorders	2
1.2 Problem Statement and Objectives	3
1.3 Benefits of Study	6
1.4 Organisation of Thesis	6
 2 LITERATURE REVIEW	
2.1 Ergonomics, Human and The Work Environment	7
2.1.1 Simplex and Complex Systems	8
2.1.2 Practise of Ergonomics and the Human-Machine	9
2.2 Human Components in the Worksystem	10
2.2.1 The Effectors	11
2.2.2 The Senses	11
2.3 Fitting A Man to The Job vs. Fitting A Job to the Man	12
2.4 Types of Anthropometric Data	14
2.4.1 Structural Anthropometric Data	15
2.4.2 Functional Anthropometric Data	15
2.4.3 Newtonian's Anthropometric Data	16
2.5 Workplace Design for Standing and Seated Workers	16
2.6 Contribution of Ergonomics and Workspace Design	17
2.7 MSD and Other Epidemiologic Studies	19
2.7.1. Nature of MSD	19
2.7.2. Type of Epidemiologic Study Designs	20
2.8 Individual Factors Associated with Work Related MSD	24
2.8.1. Age as a Factor in MSD	26
2.8.2. Gender as a Factor in MSD	28
2.8.3. MSD's Under the Impact of Smoking	30
2.8.4. Physical Activity vs. MSD	32
2.8.5. Physical Strength and MSD	35
2.9 Role of Anthropometry in MSD	37



2.10	Back Injuries, Compensation and Backbelt Use	39
2.11	Electromyography (EMG)	44
2.11.1	Muscle Tester ME3000P	45
2.11.2	Physiologic Fatigue	46
2.12	Specific studies related to MSDs	47
2.12.1	Low Back Pain and Posture	48
2.12.2	Neck Musculoskeletal Disorders: Evidence for Work Work Relatedness	51
2.12.3	Shoulder Musculoskeletal Disorders: Evidence for work relatedness	53
2.12.4	Wrist Musculoskeletal Disorder: Evidence for Work Relatedness	53
2.12.5	EMG Related Studies	54
2.12.6	Pearson's Chi-Square	55
3.	RESEARCH METHODOLOGY	
3.1	Qualitative Research Approach	56
3.1.1.	Documentary Research	57
3.1.2	Observational Research	57
3.1.3	The Delphi Technique	58
3.1.4	Experimental and Quasi-Experimental Research	58
3.1.5	Statistical Approach	59
3.1.6	Interview	59
3.1.7	Inventory System Based Methods	60
3.2	Quantitative Research Approach	60
3.3	Methodology Employed in Present Research	61
3.3.1	Sample Profile: The Company	61
3.3.2	Methodology Based on Qualitative Approach	62
3.3.2.1	The Inventory System	62
3.3.2.2	The Sample	62
3.3.2.3	Research Ethics	64
3.3.2.4	Sample Size	64
3.3.2.5	The Instrument	65
3.3.2.6	Stimuli	66
3.3.2.7	The Procedure	66
3.3.3	Methodology Based on Quantitative Approach	66
3.3.3.1	Surface Electromyogram	67
3.3.3.2	Procedure	67
3.3.4	Organismic Measurement	69
3.3.4.1	Weight Measurement	69
3.3.4.2	Height Measurement	69
3.3.5	Data Analysis Procedure	70

4.	RESULTS	
4.1	Results of Study Pertaining to Inventory System Based Investigations	72
4.1.1.	Respondents Background	73
4.1.2.	Studies related to Lower Back Pain	74
4.1.2.1	Prevalence of Lower Back Pain among Respondents	74
4.1.2.2	Study of the Age and Body Mass Index (BMI) Factors vis-vis Lower Back Pain syndrome	75
4.1.2.3	Study of Work Experience and Duration of Pain vs. Lower Back Pain (LBP)	76
4.1.2.4.	Study of Work Period vs. Lower Back Pain among Workers who have LBP and who did not have LBP	78
4.1.3	Studies Related To Neck Pain	78
4.1.3.1.	Comparison between age factor and body mass index (BMI) among workers with neck pain and who do not have neck pain.	79
4.1.3.2.	Frequency Distribution of working hours per week And the prevalence of neck pain among operators	80
4.1.3.3.	Mean differences of work period among workers who have neck pain and who do not have neck pain.	80
4.1.4	Studies Related To the Shoulder Pain	81
4.1.4.1.	Mean Differences between the age factor and body mass index among workers that have shoulder pain and workers who do not have shoulder pain	81
4.1.4.2.	Frequency distribution and chi-square test analysis on the working hours per week versus the prevalence of shoulder pain	82
4.1.5.	Studies Related To Wrist Pain	84
4.1.5.1.	Frequency distribution of workers suffering from wrist pain in the industry.	84
4.1.5.2.	Comparison of the duration of working hours among workers who have wrist pain with workers who do not have wrist pain.	85
4.2	Results of the Study Pertaining To EMG –Based Study (Study-2)	85
4.2.1.	Respondents profile	86

4.2.2.	Comparison btw. EMG erector spinae muscle Activity before and after work.	87
4.2.3.	Comparison between EMG erector spinae muscle Activity btw. Operators who have back pain and who did not have back pain.	88
4.2.4.	Analysis of Variance (ANOVA) Pertaining to Left Erector Spinae muscle for workers working in assembly Stamping, before and after work.	89
4.2.5.	Analysis of Variance (ANOVA) Pertaining to Right Erector Spinae muscle for workers working in assembly Stamping, before and after work.	91
5.	DISCUSSION	
5.1	Discussion on findings related to Qualitative Investigation	93
5.1.1.	Analysis of Lower Back Pain	94
5.1.1.1.	Prevalence of Lower Back Pain	94
5.1.1.2	Comparison between the age factor and body mass index(BMI) among workers that have lower back pain syndrome with workers that do not have lower back pain syndrome	94
5.1.1.3.	Frequency distribution for the period of work and the prevalence of lower back pain	96
5.1.1.4.	Mean differences of work period among workers who have lower back pain and who do not have Lower back pain.	97
5.1.1.5.	Relationship between lower back pain and handling heavy objects (no tests conducted)	97
5.1.2.	Analysis of neck pain results	99
5.1.2.1.	Age factor among workers that have neck pain syndrome and workers who do not	99
5.1.2.2.	Correlation between load handling and neck pain	100
5.1.2.3.	Working hours vs. neck pain	100
5.1.3.	Analysis of Shoulder Pain results	101
5.1.3.1.	Mean differences between age factor and the prevalence of shoulder pain	101
5.1.3.2.	Correlation between long working hours and shoulder pain	102

5.1.4. Correlation between work period and load handled Vs. wrist pain	103
5.2. Discussion on findings related to qualitative investigation (Study-2)	104
5.2.1. Comparison between EMG erector spinae muscle activity before and after work	104
5.3. Statistical Hypothesis Verification	106
6. CONCLUSION, RECOMMENDATION & SUGGESTION FOR FURTHER WORK	108
REFERENCES	114
APPENDICES	123
BIODATA OF AUTHOR	148



LIST OF TABLES

Table no.		Page
3.1	Statistics related to sample population	63
3.2	Statistics related to sample population	68
4.1	Distribution of race, sex and marital status of 72 respondent	72
4.2	Data related to mean age, weight etc. pertaining to respondent	73
4.3	Number and percentage of respondent that complain of different types of pain.	75
4.4	Mean age among workers who suffered from lower back pain	75
4.5	Mean BMI among workers who have backpain and workers who do not have back pain	76
4.6	Months of Experience vs. Occurrence of Backpain	77
4.7	Duration of backpain while working in factory (Study –1)	78
4.8	Mean work period among workers who have back pain and who do not have backpain	78
4.9	Mean age among workers who suffer from neckpain and workers Who do not suffer from neck pain	79
4.10	Mean BMI among workers who suffer from neck pain and Workers who do not suffer from neckpain.	79
4.11	Working hours per week vs. occurrence of neck pain	80
4.12	Mean differences of work period among workers who have neck pain and who do not have neck pain	81
4.13	Mean age among workers who suffer from shoulder pain and workers who don't suffer from shoulder pain	82
4.14	Mean BMI among workers who suffer from shoulder pain And workers who don't suffer from shoulder pain	82
4.15	Working hours per week vs. occurrence of shoulder pain	83

4.16	Pearson Chi –Square Test	83
4.17	Shoulder pain period	84
4.18	Period the wrist pain lasts among workers	84
4.19	Working hours per week vs. occurrence of wrist pain	85
4.20	Distribution of race, sex, and marital status of 72 respondents who participated in the present study	87
4.21	EMG value related to the erector spinae muscle activity of the Industrial operators before and after work	87
4.22	EMG erector spinae muscle activity of operators who has back backpain and who do not have back pain	88
4.23	Analysis of variance for the left erector spinae muscle using Repeated measure kind of statistical design	90
4.24	Analysis of variance for the right erector spinae muscle using Repeated measure kind of statistical design	91

LIST OF FIGURES

Figure no.		Page
3.1	Muscle Tester ME3000P System	71

LIST OF APPENDICES

Appendix A	The Inventory System
	(a) In Bahasa Malaysia
	(b) In English
Appendix B	Coloured Photographs of Working Postures of the Industrial Workers in PHN Industry.
Appendix C	Standard Operating Procedure For Muscle Tester
Appendix D	Electromyography System: Overview Measuring and Specification

NOMENCLATURE

EMG	:	Electromyography
AEMG	:	Average Electromyography
MF	:	Median Frequency
BMI	:	Body Mass Index
L4	:	Lumbar 4
L5	:	Lumbar 5
Kg	:	kilogram
μV	:	Microvolt
Hz	:	Hertz
S.D.	:	Standard Deviation
S.E	:	Standard Error of Mean

CHAPTER ONE

INTRODUCTION

Ergonomics or human factor engineering is a multidisciplinary activity to assemble information on people's capacities and capabilities for use in designing jobs, products, workplaces and equipment. The term ergonomics and human factors Engineering are often used simultaneously. Both describe the interaction between the operator and the job demands and both are concerned with trying to reduce human stresses in the workplace. In layman's term, ergonomics deals with the interaction between three main components; human, machine and the environment.

As a discipline, it takes as its starting point, the constitution of the individuals features (anatomical, biomechanical, physiological, psychological and social) within the work system. Ergonomics seeks to design worksystem so that it will better fit the needs of the individual.

To study the ergonomic problems in a given complex work environment, the best way to seek a satisfactory solution would be to consider the whole problem following the systems approach that assumes that each part of the worksystem may have an effect on each other. It is convenient to consider the worksystem in terms of

five main areas: task or work, machine or equipment, environment, personnel and organisation.

1.1 Musculoskeletal Disorders(MSDs)

As regards, the work-related disorders, these are typically conditions of multiple aetiology in which nature of work is a significant contributory factor and results in disorders that may occur in a wide variety of working population. Low back pain, for example, is common among labourers, nurses, truck drivers, and office workers; repetitive strain injuries occur in production line workers and keyboard operators. The identification of underlying risk factors may be a complex problem. – both epidemiologically and ergonomically. Work related musculoskeletal disorders may result from single episodes of exertion or the cumulative overuse or a combination of both. Cumulative overuse may be due to working postures, strenuous physical activity, repetitive motions or any combination of these characteristics.

Low back pain is the most common of the work related musculoskeletal disorders, and in common economic terms is very costly. Back pain may be due to a number of causes: For example, postural abuse which is mainly due to poor standing posture, whereby the person is slump in one way or another, sagging, losing muscle tone, hanging on the hip and spinal elements, mistreating and stressing all the structures in and around the motion segment, etc are the ones being commonly reported in the literature.

1.2 Problem Statement and Objectives

Work related musculoskeletal disorders occur when there is a mismatch between the physical requirements of the job and the physical capacity of the human body. More than 100 injuries can result from repetitive motions that produce wear and tear in the body. Back pain, wrist tendinitis and carpal tunnel syndrome may all stem from work related overuse. Specific risk factors associated with MSDs include repetitive motion, heavy lifting, forceful exertion, contact stress, vibration, awkward posture and rapid hand and wrist movement resulting in the rising costs of lower back disorders (Bigos *et al*, 1986). Many researchers have stressed the rising costs of low back disorders and its burden on the industry (Mitla et al., Sommerich and Marras, 1992; Kumar and Garrand, 1992; Ayoub, 1992). According to one of the recent report by Chaffin (1997), manual material handling(MMH) injuries comprised 52% of all work related injuries in the United States, disabled 5 million workers and costing approximately 100 billion dollars a year.

In 1998, more than 647,000 American workers experienced serious injuries due to overexertion or repetitive motion on the job. These work-related musculoskeletal disorder (WMSD) accounts for 34% of lost workday injuries. WMSDs cost employer an estimated \$15 billion to \$20 billion in workers compensation costs in 1997 and \$45 to 60 billion more in indirect costs(Bernard B. et al.,1994).